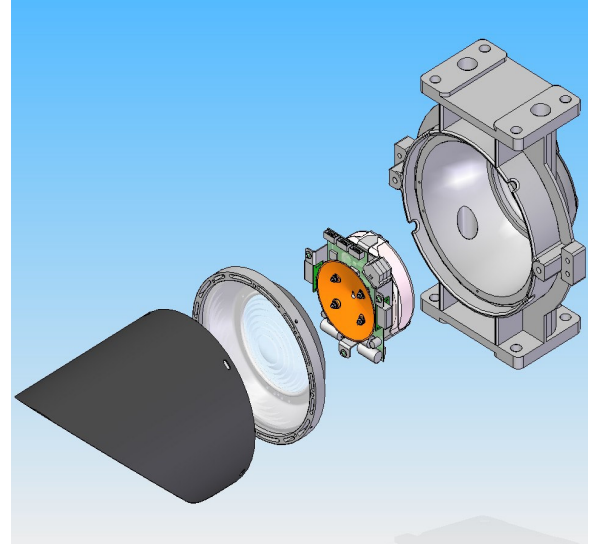


## Environmental Product Declaration

### *EBI Light 2000–LED (Light Emitting Diodes) based signals*

#### *Product description*

Signals are an important part of the rail transport's safety system. They are located in/at the track to direct trains, inform drivers and persons near the tracks and detect track occupancies. LED based signals, available in different colours, use diodes to emit light instead of the traditional light bulbs. For maintenance and material replacement this technique has great advantages since light bulbs needed replacement more than every second year. The life length of the diodes is now 12 years, and they are maintenance free. The modern construction makes it possible to use components and soldering techniques compliant with RoHS, the European directive that restricts certain hazardous substances in electrical and electronic equipment. It is a great environmental improvement that the heavy metals associated with light bulbs and traditional circuit boards now are removed. The energy consumption in the use phase due to the emission of light is also much lower for the LED based technique, in fact 12 times lower.



#### *System boundaries*

The information is based on the construction named EHE-1 mounted in the signal head JHAD-2 by Bombardier's Rail Control Solution site in Katowice, Poland. The Life Cycle Assessment (LCA) overleaf covers environmental aspects for extraction and production of the raw materials used, transportation of major parts to the assembly plant, and energy consumption for final assembly (1 kWh) and the use phase (210 kWh). It also covers the end-of-life activities. No maintenance or replacement of materials is expected during the lifetime.

#### *End-of-life*

Recyclability calculations are based on existing recycling processes that are commercially available and technically possible today. Energy recovery is included in the recyclability rate that is estimated to be 93 %.

Manufacturing materials (kg)	Total per EBI* Light	The Weight [%]	Recyclability [%]
Aluminium	5,8	78	100
Iron	0,5	7	100
Copper	0,5	7	100
Polymers	0,2	3	52
Other material	0,4	6	0
<b>Total</b>	<b>7,4</b>	<b>100</b>	<b>93</b>

Materials in need of special treatment at End-of-life are 0,26 kg.

**Environmental Profile – Results from LCA according to ISO 14040**

The functional unit is one signal head with one LED unit in service for 12 years.

**Resource utilisation**

Primary energy resources (kWh)	Manufacturing	Use	End-of-life	Total life cycle
<b>Non Renewable</b>				
Nuclear	0,302	97	0	98
Oil	0,069	4,3	0	4,4
Coal	0,306	4,2	0	4,5
Gas	0,134	0,6	0	0,7
<b>Renewable</b>				
Hydropower	0,168	98	0	98
Biomass	0,015	4,1	0	4,1
Wind power	0,004	0,4	0	0,4

Material (kg) Resources	Manufacturing	Use	End-of-life	Total life cycle
Aluminium	5,8	0	-5,8	0
Iron	0,5	0	-0,5	0
Copper	0,5	0	-0,5	0
Polymers	0,2	0	-0,1	0,1
Other material	0,4	0	0	0,4
<b>Total</b>	<b>7,4</b>	<b>0</b>	<b>-6,9</b>	<b>0,5</b>

**Impact categories to which all the emissions are grouped:**

Environmental impact categories	Unit	Manufacturing	Use	End-of-life	Total life cycle
Global warming potential (GWP)	kg CO <sub>2</sub> equiv.	87	11	-61	37
Ozone Depletion Potential (ODP)	kg CFC 11 equiv.	0,000005	0,000006	-0,000003	0,000008
Acidification (AP)	mol H <sup>+</sup> equiv.	16	3	-12	7
Eutrophication (NP)	kg O <sub>2</sub> equiv.	0,8	0,2	-0,3	0,7
Photochemical Oxidant formation (POCP)	kg Ethene equiv.	0,009	0,005	-0,005	0,009

The **material resources** cover the materials used for manufacturing of the LED based signal.

The **energy resources** cover energy needed during manufacturing and use of the LED based signal. A European mix of electricity during the manufacture and a Swedish electricity mix during the use phase is assumed.

The **materials in need of special treatment** are identified according to knowledge of existing recycling processes that are commercially available and technically possible today.

**Manufacture** covers the materials and energy needed for assembly of the LED based signal.

**Use** covers the predicted and estimated processes during the use phase.

**End-of-life** covers recycling, incineration with energy recovery and landfill. Credit for recyclability of metals and polymers is achieved by deducting the impact of production of the same virgin material or energy.

**Total** sums up the manufacture, use and end-of-life phase.

**Included in the LCA:**

- Data for raw materials used throughout the life cycle
- Transportation of main components to final assembly
- Energy consumption during assembly and use

**Not included:**

- Manufacturing processes at suppliers
- The raw material waste produced in the manufacturing process
- Effects of possible accidents
- Energy and emissions for the end-of-life treatment

\* Trademark(s) Bombardier Inc. or its subsidiaries

This EPD is performed according to ISO 14021

For further details regarding the LCA, see 3EST 7-3122 Life Cycle Assessments of RCS products ver 1.0